agriculture

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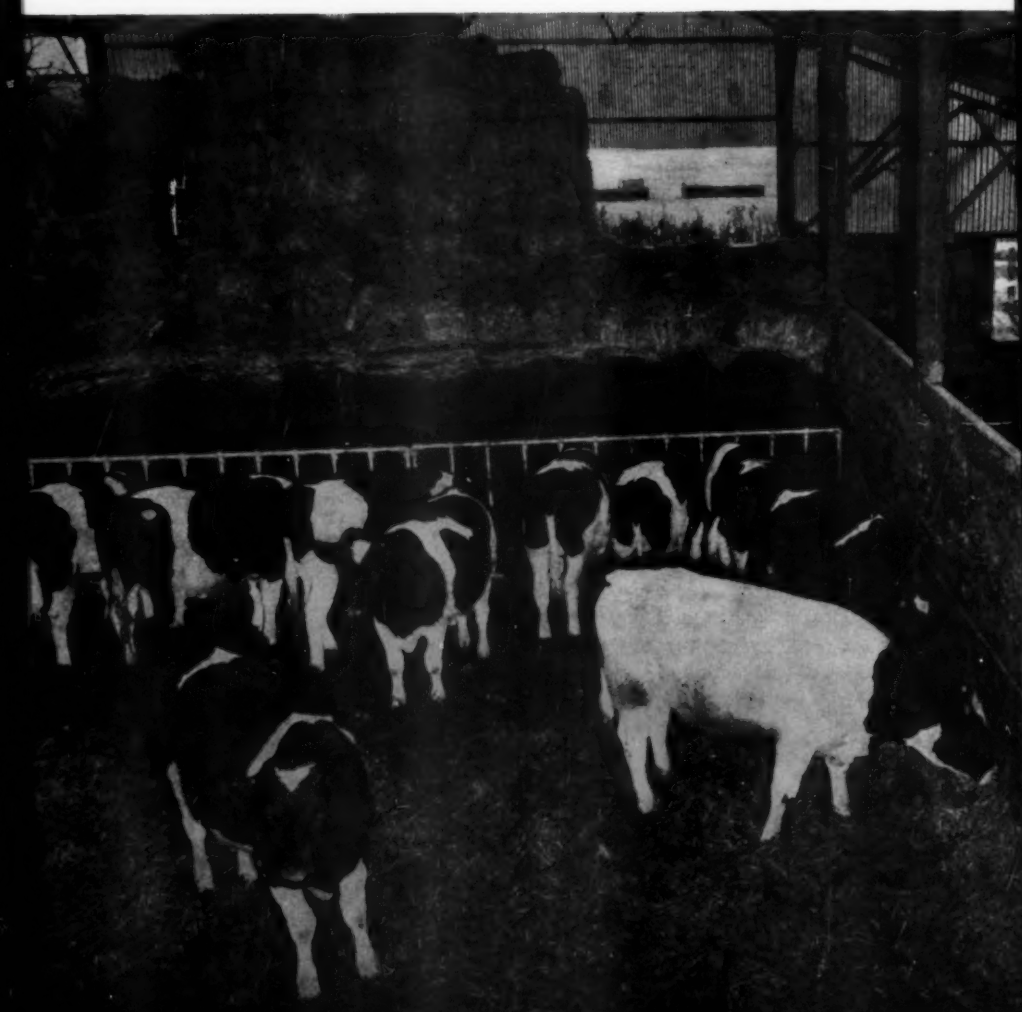

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Farm-electric Centre

R. G. Scott

FARM-ELECTRIC, the electricity supply industry's comprehensive new service for the agricultural industry, commenced operation in November 1971. Its focal point is the Farm-electric Centre, situated at the heart of the National Agricultural Centre's demonstration area at Stoneleigh.

The Farm-electric Centre was established in 1967 as the Electro-agricultural Centre and is operational throughout the year. Its specialist staff work in close liaison with agricultural officers of the Electricity Boards who are well qualified to provide individual advice based on experience of a farmer's own locality.

National shop window

Providing a mains supply of electricity to over 98 per cent of rural premises in England and Wales has entailed the electricity supply industry in a capital outlay well in excess of £150 million. The industry had, of course, provided a comprehensive service to farmers for many years; future needs have been anticipated and ways of meeting them continually researched. Publications

and films, conferences, exhibitions and demonstrations, as well as training and the provision of advice on all electro-agricultural problems, have all been provided. But, as in any commercial undertaking, a reasonable return on investment is required. Marketing is therefore essential, but this is by no means a simple task when the commodity cannot even be seen—let alone invitingly packaged!

The founding of the National Agricultural Centre as an all-year-round focal point 'to assist the spread of agricultural information, whether husbandry, technical or management, to increase productivity' presented the Electricity Council with an opportunity for a national shop window.

The Electro-agricultural Centre was founded so that the electricity supply industry could complement the overall objectives of the National Agricultural Centre in the closest possible way. The original aims, which have been reaffirmed, were to provide:

a. Information on all forms of application of electricity in agriculture.
b. Comprehensive library service for information on commercial equipment and techniques.
c. Liaison for electricity in all the N.A.C. demonstration areas.
d. Training, conference and demonstration facilities.
e. Exhibits and features for all special events at the N.A.C.
f. Customer liaison with Electricity Boards throughout the country.

Librarian at work in the Commercial Product Section at the Farm-electric Centre

Information services

The primary objective has been to provide a comprehensive information service to the widest possible sector.

Information on the use of electricity has been disseminated mainly through the Centre's Library Service and by personal visits to the permanent Information Display. The Library contains commercial data from almost 1,000 firms and covers some 3,000 items of equipment, ranging from aerosol generators to waste disposal systems. Details of appliances and sources of supply are freely available to enquirers. Advisory officers have found this facility

A view of the Information Display Hall showing some of the interesting working exhibits

particularly useful in obtaining up-to-date material for their work in the field.

In addition to commercial files, a section is devoted to technical articles, abstracts, books and references covering new developments, and research and utilization projects from world-wide sources. Close links with other national and international organizations ensure that their material can be drawn upon whenever necessary. Research and education establishments regularly draw on the Centre's stored information and some of the latter use Electricity Council technical publications as standard textbooks.

The Information Display Hall is a permanent feature devoted to fundamental electrical techniques. It concentrates on explaining ways in which

A visitor to the Information Display Hall tests some of the barn dried hay on display

electricity can be employed to improve farming productivity. Willing co-operation by manufacturers has enabled a wide range of typical equipment to be shown and in most instances demonstrated. Items are frequently changed to incorporate new developments and the comprehensive display is probably the best of its kind to be seen anywhere. Electrical applications are shown in sections covering farm wiring and installation, the use of motors and controls, ventilation, lighting, heating, crop treatment and storage, feed preparation, dairy requirements and water treatment.

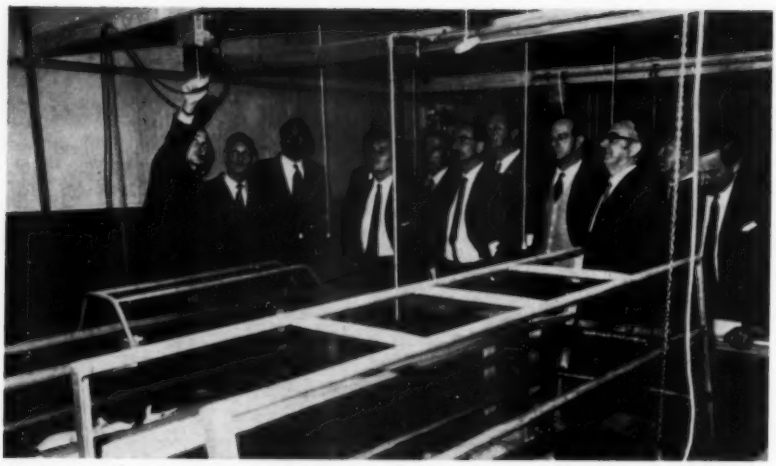
In many cases the displays provide an introduction to full-scale installations within the N.A.C. Livestock Units, where equipment can be seen working under practical conditions. This is one result of the close liaison maintained with all the units. A two-way flow of mutually beneficial information is another.

Visitors to the Centre include individuals who come to discuss specific problems, while others may be in parties arranged by the electricity supply industry, the N.A.C. and the various sponsoring organizations. Among those welcomed have been many A.D.A.S. officers, groups of agricultural students from British and overseas establishments, farmers, contractors and others, including embassy officials from countries as far afield as the U.S.S.R. and Australia. Womens Institute members and rural domestic economists, too, have been well represented in the 9,000 or so visitors who have up to now been given conducted tours. Visits of a technical nature are frequently extended to take in one or more of the Livestock Units and visitors who come primarily to see the Units often visit the Farm-electric Centre as well.

Centre facilities

Facilities provided at the Centre for training, conferences and demonstrations have been used extensively over the past four years. There is a conference room with modern visual aids accommodating 50 persons, with an adjacent lounge and a catering service room. This suite is available, at a nominal charge, to organizations having allied interests and has often been used by A.D.A.S. and the Training Board as well as N.A.C. Unit sponsors. Initially

Area Electricity Board staff at a training session at the Centre in 1971



M.A.F.F. Safety inspectors in a farrowing house during a one-day conference on electrical supply at the Farm-electric Centre

conferences were held to acquaint national organizations with the purpose and availability of the Centre. Subsequently, technical conferences have been organized on such subjects as farm waste treatment, refrigeration in grain and potato storage, crop conservation and electrical safety on the farm.

Special events at the N.A.C. which involve Centre participation include the annual Royal Show and the National Grassland Demonstration. The role of the Centre at the 'Royal' is well-known. Full scale demonstrations of barn hay drying are staged at the N.G.D. For these and similar occasions additional staff are provided by Area Electricity Boards to assist the two full-time technical specialists based at Stoneleigh.

The industry's agricultural staff are supported by sales engineers, for whom some agricultural background is obviously necessary. Two-week basic training courses have been organized for them at the Centre for the past three years. Usually attended by 20-25 engineers, the course covers such subjects as the control of environment, farm feed preparation, crop husbandry and dairying. Unit managers, A.D.A.S. officers, electrical specialists and others co-operate to provide an appreciation of practical husbandry problems. Visits to installations at the N.A.C. and local farms further the practical nature of the courses which, judging by the results, have been well worthwhile.

Courses are also held during the Easter vacation for agricultural engineering students from the University of Reading and the National College, Silsoe. Designed to provide a practical extension of academic studies, these courses usually cater for 20-24 students and have become an integral part of the syllabus of the National College. Specialist short courses have also been held from time to time for advisory officers and staff of compound feed firms on equipment for environment control and food processing.

Another service provided is customer-liaison with specialists in Electricity Boards. Enquirers are supplied with basic information and put in touch with their local man for follow-up or on-the-spot advice.

Features of interest to be seen at the Centre are the Dutch barn, the temporary display building, the all-electric bungalow and the fully-stocked

greenhouse with many automatic controls. There is also a well-equipped workshop with tools which are used for routine maintenance as well as for exhibition purposes. Modern wiring practices are demonstrated throughout these buildings.

The future

The Farm-electric Centre provides an information retrieval service concentrating on all matters of interest common to both electricity and agriculture. It also affords a unique and practical background for demonstration, personal visits and technical discussion. It operates all the year round and is freely available to all.

The Centre's 1972 programme already includes participation in the International Dairy Farming Event, the National Grassland Demonstration and the Town and Country Festival and steadily increasing numbers of visitors and enquiries from home and overseas are expected to make use of its expanding service. The Centre will continue to be forward-looking and to present information in a practical manner to practical people.

Readers who may be encouraged by this brief survey to make use of these services will find it well worthwhile.

The author, **R. G. Scott,** a Senior Assistant Engineer of the Electricity Council, manages the Farm-electric Centre.

National Grassland Demonstration Again in 1972

On 31st May and 1st June 1972, the National Grassland Demonstration will take place at the National Agricultural Centre at Stoneleigh.

Manufacturers will demonstrate all the latest grassland machinery in action on the working plots, and there will also be static machinery displays and a working demonstration of mowers and mower conditioners. A full range of advisory exhibits covering every aspect of grassland management and conservation is being organized, with contributions from the Agricultural Development and Advisory Service, the National Institute of Agricultural Engineering, the Grassland Research Institute, the Milk Marketing Board, the Meat and Livestock Commission, the National Institute of Agricultural Botany, the National Agricultural Centre and Shellstar Limited.

These organizations are all represented on the governing body, the N.G.D. Advisory Committee. In view of rising costs the Committee has decided to make a charge of 50p per head for entrance.

In previous years the event has attracted a very large number of farmers anxious to view machinery under practical working conditions and to profit from the advisory exhibits. Since the last N.G.D. in 1969, a number of new techniques have come to the fore, and there should be plenty to see in 1972.

For further information about the 1972 Demonstration, please contact Mr. R. T. R. Pierce, Secretary of the National Grassland Demonstration Advisory Committee, Shellstar Limited, Ince Marshes, Ince, nr. Chester CH2 4LB.

Bleasdale farmers try their hand at condition assessments

Lambing potential depends partly on the ewe's condition at mating. A guide to this is

Condition Scoring of Hill Sheep

S. A. C. Oliver **J. S. Broadbent**

THE profitability of hill sheep is largely related to the number of viable lambs produced per ewe each year. This can be influenced by many factors and the final figure may bear little resemblance to the potential production of the ewe. The number of lambs born depends, firstly, on the number of ova shed in the oestrus cycle at which mating occurs; secondly, on whether these ova are fertilized; and thirdly, on the embryo mortality or wastage up to the time of parturition. It is most important, if a high level of lamb output is to be obtained, to ensure that the optimum number of ova are shed and fertilized at the oestrus of mating, and thereafter that embryo mortality is kept to a minimum.

Ovulation potential in sheep is genetically determined in so far as there is considerable variation between different breeds, but within the limits imposed by breed there is considerable variation caused by environmental factors. Nutrition is the most important of these because of its influence on body condition, but climate and management can also play an essential part in some circumstances. Body condition of the ewe at mating has a significant influence on barrenness and ovulation rate. Ewes in better condition at mating tend to produce more lambs than those in poor condition; they milk better and their lambs tend to be more viable at birth.

What is condition? How does a ewe in good condition differ from one in poor condition, and is either of them in the right condition? It is doubtful if these equivocal phrases have the same meaning to all shepherds and flockmasters.

Scoring system

In an attempt to overcome this difficulty a system of condition scoring has been developed. Quite simply this involves giving a score on a scale ranging from 0 to 5 to individual animals according to their fatness. The object of this method of scoring by definition is to enable a person to describe with precision the fatness of a sheep in a way which will convey something meaningful to another person. The system described here was devised in Australia and has recently been developed by research workers in this country.

The success of the system depends primarily on the clear and precise description of certain physical characteristics identifiable in sheep of different degrees of fatness. These characteristics are assessed in the lumbar region of the animal—on and around the backbone in the loin area, immediately behind the last rib and above the kidneys.

The first stage is the assessment of the prominence, i.e., the degree of sharpness or roundness of the spinous processes of the lumbar vertebrae—these are the bony parts or spikes rising upwards from the backbone. The second step is to assess the prominence of, and degree of cover over, the transverse processes of the vertebrae—the horizontal bones coming out from either side of the backbone. Thirdly, the extent of the muscular and fatty tissues below the transverse processes is judged by the ease with which the fingers pass under the ends of these bones. Finally, the fullness of the eye muscle and its degree of fat cover are evaluated in the angle between the spinous and transverse processes. Animals are then awarded a score according to the following scale:

Grade 0: extremely emaciated and on the point of death. It is not possible to detect any muscular or fatty tissue between the skin and the bone.

Grade 1: the spinous processes are prominent and sharp; the transverse processes are also sharp, the fingers pass easily under the ends, and it is possible to feel between each process; the eye muscles are shallow with no fat cover.

Grade 2: the spinous processes are still prominent but smooth, and individual processes can be felt only as fine corrugations; the transverse processes are smooth and rounded, and it is possible to pass the fingers under the ends with a little pressure; the eye muscles are of moderate depth but have little fat cover.

Grade 3: the spinous processes have only a small elevation, are smooth and rounded, and individual bones can be felt only with pressure; the transverse processes are smooth and well covered, and firm pressure is required to feel over the ends; the eye muscles are full and have a moderate degree of fat cover.

Grade 4: the spinous processes can just be detected with pressure as a hard line between the fat-covered eye muscles; the ends of the transverse processes cannot be felt; the eye muscles are full and have a thick covering of fat.

Grade 5: the spinous processes cannot be detected even with firm pressure, and there is a depression between the layers of fat in the position where the spinous processes would normally be felt; the transverse processes cannot be detected; the eye muscles are very full with very thick fat cover; there may be large deposits of fat over the rump and tail.

Assessing the condition of hill ewes

Top left: *Step One—the thumb feels for fat either side of the spinal vertebrae*

Top right: *Step Two—the flat of the hand rubbed across the loin assesses fleshing*

Left: *Step Three—finger tips feel for coverage of the short loin laterals*

In practice, it is most unlikely that in a flock of sheep the range in condition will be much more than two grades at any one time. In order to describe fully the variation within a flock it is usual to score sheep to the nearest half grade.

Verifying results

In an attempt to check the effectiveness of the condition scoring system to estimate body fat, Russel, Doney and Gunn (1969)* found a close relationship between body fat subjectively assessed in live Blackface ewes and body fat as determined chemically in the carcases of the same animals. Carrying the work a stage further that year, Gunn, Doney and Russel† found also in Blackface ewes a good relationship between body condition at mating and subsequent fertility as measured by percentage of barren ewes and percentage of multiple births. They also found that food intake prior to mating had no effect on ewes already in good condition (Grade 3) but did have an effect on the number of lambs born to ewes in Grade 1.5. It was felt from these results that the relationship between body condition and fertility may not be linear; in other words there may be a threshold level of condition above which there is little or no improvement in fertility.

The importance of nutrition has long been recognized. 'Flushing' is an old established practice of sheep husbandry which involves a sudden increase in food supply, and hence body condition, a week or two before mating. In many cases it also involves a deliberate reduction in body condition a few weeks before flushing, although the evidence to support this practice is inconclusive.

Experimental trials

Trials have recently been carried out on two Ministry Experimental Husbandry Farms and on a commercial farm by A.D.A.S. advisers. Ewes were scored and weighed at mating and records were kept of the number of lambs produced by each ewe. The objectives of the trial were to assess:

1. the relationship of body condition at mating to subsequent lambing performance;
2. the comparative value of condition score and body weight as indicators of subsequent lambing performance;
3. the relationship between condition score and body weight at mating.

The results calculated from a total of 559 ewes divided into five separate groups confirm the basic hypothesis that as body condition at mating improves, the subsequent output of lambs also improves. Translated into absolute terms, the results show in answer to the questions posed above, that:

1. Over the ranges covered by the data in the various groups considered, with each increase of 1 in condition score, the number of lambs produced per ewe increased by a figure ranging from 0·035 (3·5 per cent) up to 0·316 (31·6 per cent). These are results from the two groups of sheep which showed the smallest and biggest increases respectively. The other three results fitted into the pattern in intermediate positions.

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*Gunn, R. G., Doney, J. M., Russel, A. J. F. (1969). *Fertility in Scottish Blackface Ewes as influenced by nutrition and body condition at mating*. J. Agric. Sci. 73. 289. Russel, A.J.F., †Doney J.M. and Gunn, R.G. 1969. *Subjective assessment of body fat in live sheep*. J. Agric. Sci. 72. 451.

2. In all five groups it was shown that condition scoring was at least as accurate and in some cases very much more accurate as an indicator of lamb production than was body weight.
3. In all groups there was a positive relationship between condition score and body weight at mating. The value in weight terms of 1 condition score unit varied from 5·5 lb up to 17·8 lb. This large difference between groups of sheep is perhaps to be expected because of the relatively small numbers of ewes in some of the groups.

What do these results mean in practice? Although for the present based on rather limited evidence there is little doubt about the basic relationship between condition score at mating and lamb production. There is also little doubt that condition scoring has a greater predictive value than has body weight at mating because body weight not only reflects differences in body condition but also in body size. The technique itself, when learned, is fairly straightforward, quickly performed and requires no expensive equipment. A skilful operator should be able to grade up to 200 ewes per hour through a shedder.

Advantages of system

The application of condition scoring should allow a greater degree of precision to be introduced into hill sheep farming. Every hill must have an optimum in terms of size of flock and lambing percentage of that flock. This will depend on many factors such as the type and distribution of plant species, fencing or lack of it, proportion of inbye land to hill, facilities for handling twins, presence or absence of natural hazards, accessibility and labour availability. On the poorer hills, where vegetation is sparse, the target lambing percentage will perhaps be 100 per cent—every ewe with a single lamb; it should not normally be lower than this. As hills become better, or associated with a higher proportion of inbye ground, the number of twins can be allowed to rise. The evidence so far seems to suggest that ewes in Grade 2 at mating should achieve 100 per cent lamb crop whereas those in Grade 3 should achieve a considerable proportion of twins.

The practical application of the technique would, therefore, involve scoring the ewes 4-6 weeks before mating. This would give a guide to the management required before mating. It may be best to draft off any poorer ewes for special treatment to improve their condition. If the ewes can achieve the correct body condition at mating the foundation will have been laid for a lamb crop which will makes the best use of that particular hill farm.

S. A. C. Oliver, N.D.D., is National Hill Stock specialist serving with A.D.A.S. at the Regional Office, Newcastle-upon-Tyne and **Dr. J. S. Broadbent** Sheep specialist, also serving with A.D.A.S., and stationed at the area office, Skipton, Yorks.

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Dog Owners — please keep your dogs under proper control during the lambing season to prevent the needless slaughter of harmless animals!

Sows on free range

An expanding pig population has led to rapid developments in Yorkshire's

East Riding Piggeries

A Maclean

THE East Riding of Yorkshire has a higher pig population per acre than any other county in England and Wales. It can be said that the county has seen a pig population explosion over the past five years or so, the numbers of breeding pigs having increased by 30 per cent compared with a national average of 7 per cent. A few years ago it was a common sight to see large numbers of sows on free range, rooting and scavenging on arable pasture, but due to the pressures imposed upon the farmer as a result of increasing land values and other costs, extensively managed pig breeding herds are now a relatively rare sight.

Farmers in the area have quickly come to realise that pig farming is an exacting and critical business. They have found by experience that it is bad economics to invest large sums of money in palatial high cost buildings, and have also appreciated the problems of labour usage, especially concerning muck disposal. The county is, however, fortunate in having the major sea port of Kingston upon Hull near at hand, making timber—widely used in the construction of pig houses—and other raw materials required in the manufacture of feedingstuffs, readily available at relatively competitive prices.

The progressive attitude of the farmers has led them to exploit this advantage and they have combined it with the pioneering of new systems and husbandry developments. A large number of parties visit the county annually to study methods of pig husbandry, and the impressions they take away

reflect the unique developments and innovations which they have seen. It must not be presupposed that problems do not exist; indeed they do, a major one being the disposal of slurry. This problem, and muck disposal in general, involves a great deal of thought and planning as a first step in the development of a pig unit. Schemes are, however, rapidly being developed which help to overcome this problem.

Breeding developments

DRY SOWS

The pattern of pregnant sow management in the county has rapidly moved away from the system of extensive management, through the stage of loose housing in yards, until the present when the majority of breeding sows are housed in one of a number of types of stall system. The most popular stall system in operation is probably that illustrated at Fig. 1 wherein the animals are tethered. This system is usually the cheapest to install and makes management of the sow easier, especially in relation to observance of oestrus. The cost of this method ranges from £30 per sow place in a 'do-it-yourself' building to £65 per sow in commercial package deal units.

Fig. 1 Sow tethers

SUCKLING SOWS

It is usual in the county to select a housing system for the suckling stage which replicates as far as possible the type of housing used for pregnant sows. It is therefore usual to see units where the sows farrow and are permanently tied during the suckling period (Fig. 2). In this system of husbandry the sow is farrowed and individually rears her young for a period of about three weeks; after that the low dividing partitions are removed, allowing a selected number of litters to multiple-suckle (Fig. 3) before weaning at five weeks of age and removal to the weaner battery. Three-week weaning is also practised using this system, and it is becoming increasingly popular and successful in some circumstances. There are several variations of this system in the county as well as many other quite different farrowing rearing systems. Costs range from £50 per pen for the system described above to £140 for a package-deal unit designed exclusively for individual rearing.

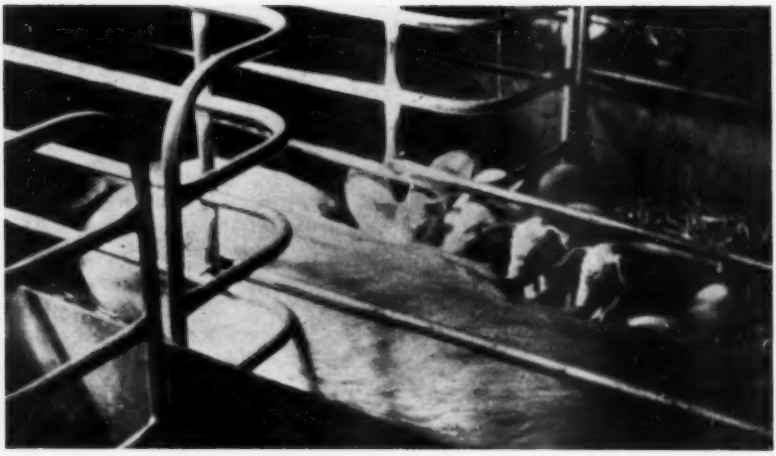

Fig. 2. Individual suckling of litter

WEANER BATTERY

The weaner battery was developed in East Yorkshire, and although its use is not yet widely seen in other parts of the country it is probably one of the most economic and successful weaner houses ever to be used in pig husbandry. Piglets are moved to the house at 3-6 weeks of age depending on the husbandry system, and are reared either by floor feeding or self-feed hopper until they are approximately 80 lb liveweight. The interior of the building incorporates a fully enclosed kennel system with an adjustable lid to allow air movement and ventilation on a natural basis. The outside dunging area is of expanded metal construction and sited over a slurry channel. The dunging area can be partly covered over with a perspex lid when three-week weaning is the practice, and when the site is in an exposed position. Performance of pigs, so far as food conversion, daily liveweight gain and contentment are concerned, has been

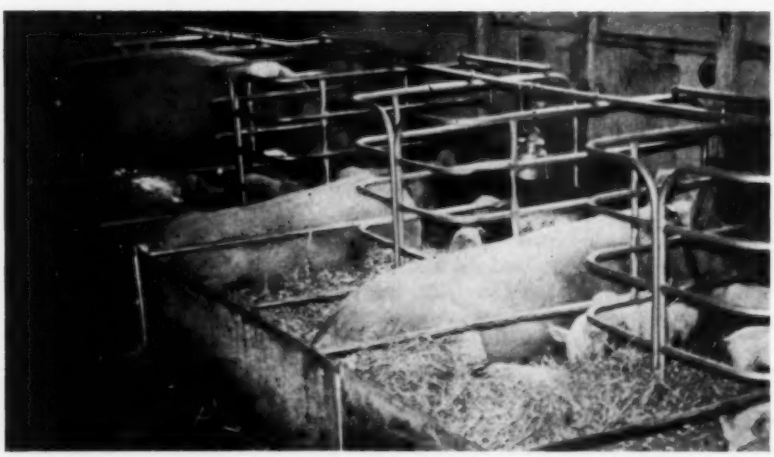

Fig. 3. Multiple suckling of litters

extremely good. At a cost of £4-5 per pig place at 80-100 lb liveweight this building (Fig. 4) has proved to be a major success.

Fig. 4. Weaner battery

Feeding

It is essential that the maximum throughput of pigs within the area of a building is achieved as the productive area of a fattening piggery is the area in which the pigs lie. If the lying space is not fully occupied the throughput of the building must be adversely affected and the capital cost per pig housed will increase. The lying area within a building must be kept full of pigs at all times. A recent national A.D.A.S. survey has shown that on average pig fattening buildings are only 75 per cent utilized; by applying this criterion to a bacon house erected at a cost of £12 per pig place, the actual cost of a badly managed building would in fact work out at £15 per pig place.

There are a number of widely used feeding systems in the East Riding. Wet mix feeding by pipeline is commonly practised and in many situations the system has been found to be invaluable when existing buildings are being converted. Food conversion may also be improved with wet feeding.

Floor feeding of bacon pigs has also been widely adopted with meal in the early stages but more recently using pelleted feed. In the smaller bacon houses this method of feeding is carried out by hand but a development into automatic floor dispenser feeding systems has been noticeable of late in the larger bacon producing units.

Pen divisions

To ensure that the bacon pens are kept full at all times, various techniques are used within the husbandry system. In houses with a central feeding passage, it used to be common to have incorporated in them a movable pen front which shut off an area of the pen when the pigs were small. This reduced the

depth of the pen but wasted floor space. A development from this was to make the pen divisions movable sideways so that the pens were narrowed without loss of pig lying area.

In houses where automatic floor dispensers are used, and where pen divisions usually have to be fixed, the use of tubular steel divisions are becoming popular. This type of pen construction is reputed to allow for easier moving of pigs, in that they have been found to fight less and so small batches remaining in pens can be mixed in order to keep the pens up to their optimum capacity. Ventilation within the building is also said to be improved when pen divisions are of this type. A recent development as an integral part of a bacon producing enterprise is the use of bacon crates. These are fixed side by side over a slurry channel and are used to confine pigs which have not quite reached bacon weight when their pen mates have gone for slaughter. This allows the pigs to get individual treatment free from bullying, while the pen from which they have been removed can once again be completely filled with a further batch of pigs. The cost of bacon pig housing in the East Riding is approximately £9-12 per pig place. It is important to point out that a very high standard of management is essential in these highly intensive systems which I have described.

Slurry disposal

On intensive pig systems a slurry storage and disposal system is usually an integral part of the enterprise and it is natural therefore that the East Riding has a large number of such systems.

The use of slurry as a method of effluent disposal has many advantages, the main being the creation of easier working conditions for the stockman and a reduction in overall farm labour involvement. The method also has disadvantages; farmers are well aware of the hazards of polluting watercourses and streams and are taking precautions to avoid doing so. A variety of disposal systems, ranging from under-slat and tank storage to graded lagoons, can be widely seen throughout the county. In the final stage of a graded lagoon system the liquids are used to irrigate potatoes and other crops.

Conclusion

The development of pig keeping systems in the East Riding of Yorkshire has been rapid and widespread use has been made of the best breeding stock available in the country. This has been combined with efficient husbandry techniques and the attitude of mind that pig keeping is now a major business and not the secondary enterprise it once was.

All building costs quoted in this article are before any grant payment.

The author, **A. Maclean, L.I. (Biol.), N.D.A., S.D.A. (Hons.),** is the Divisional Livestock Husbandry Advisory Officer with A.D.A.S. at Beverley, Yorkshire.

Pregnancy Testing in Ewes

Carol Richardson

PREGNANCY in the ewe is usually diagnosed by palpation of the ewe's abdomen and by assessing udder enlargement. This method of examination is quick, easy and cheap to perform, diagnostic equipment is not required and the operator performing the test can with practice obtain a fair degree of accuracy. Unfortunately pregnancy cannot be determined by this method until six weeks before term, and foetal movement is not appreciable until three weeks later. Whether an apparently barren ewe is truly non-pregnant also arises and may remain unsolved until the lambing season ends. If the flockmaster assumes that the majority of the ewes carry twins and feeds all the flock accordingly, food consumption by barren stock constitutes a small but undesirable wastage. Unless the flockmaster is skilled, his accuracy in detecting pregnancy by abdominal palpation is likely to be unreliable, and udder development is a useful guide to pregnancy only in gimmers; adult multiparous ewes sometimes show progressive enlargement of the udder but do not produce a lamb.

Ultra-sonic techniques

During the last ten years, ultrasound has been employed in human obstretrics and recently a modified instrument called the foetal pulse detector* has become available for the detection of pregnancy in sheep. The instrument is easy to use and quickly and accurately detects live foetuses during the early stages of pregnancy. The basic principle of the ultrasonic method lies in the fact that if inaudible ultrasonic waves are directed at a moving object, the reflected waves return at a different frequency and the difference between the incident and the reflected waves can be converted into an audible sound. In the living body the flow of blood to the heart or blood vessels will reflect an incident ultrasonic wave and audible signals of blood flow can be produced. The instrument will detect heart and pulse rates of both the dam and the foetus but, by positioning the transducer on the lower abdomen of the ewe, foetal sounds only are recorded. The instrument consists of an amplifier and a cylindrical transducer probe which contains transmitting and receiving crystals. Signals from the probe are relayed to the battery-operated amplifier, which is contained in a fairly robust outer protective casing; the control panel has an ON/OFF switch, a volume control knob and a meter which indicates the state of charge of the rechargeable battery. The dimensions of the instrument vary with the make; in general it is approximately 30 × 20 × 15 cm (12 × 8 × 6 in.), and weighs about 4 Kg (9-11 lb) (See Fig. 1).

*'Doptone Mark 1' Foetal Pulse Detector, Smith Kleine Instrument Co., Welwyn Garden City.

'Allard-Sonicaid Model V601', Allard International Pty. Ltd., Gerrards Cross.

'Centaur Doppler Foetometer', Centaur Veterinary Equipment Ltd., Edinburgh.

Fig. 1. Foetal pulse detector showing the encased battery and transducer probe

The technique of pregnancy detection using the ultrasonic instrument involves restraining the ewe in one of three positions—standing (see Fig. 2), lying flat on her side, or in the shearing position. Oil, such as olive oil, liquid paraffin or cooking oil, is applied to a wool-free skin surface, on the lower abdomen, just in front of the udder (see Fig. 3). The probe is gently pressed into the lubricant and then moved and angled on either side of the abdominal mid-line. The foetal heart makes a characteristic galloping sound at a rate of

Fig. 2. The transducer probe is placed on wool-free skin approximately 4 in. in front of the udder. The photograph shows a ewe being restrained in a standing position

approximately 3 beats per second; the blood flowing through the umbilical cord produces a blowing, swishing sound at the same rate. Infrequently a recording of the maternal artery is made; this sound has a deeper resonance and usually a slower rate.

Provided the flock is gathered and penned prior to examination, an operator can examine at least ten ewes per hour, some as many as sixty. With assistance the task is easier and quicker, the examiner concentrating solely on the use of the detector. Pregnant ewes are detected quickly, most examinations taking no longer than three minutes, but suspected barren ewes have to be examined for at least five minutes, or are re-examined at a later date. The absence of foetal sounds does not necessarily indicate non-pregnancy although a skilled operator may be justified after a five-minute 'silent' examination in making a negative pregnancy diagnosis.

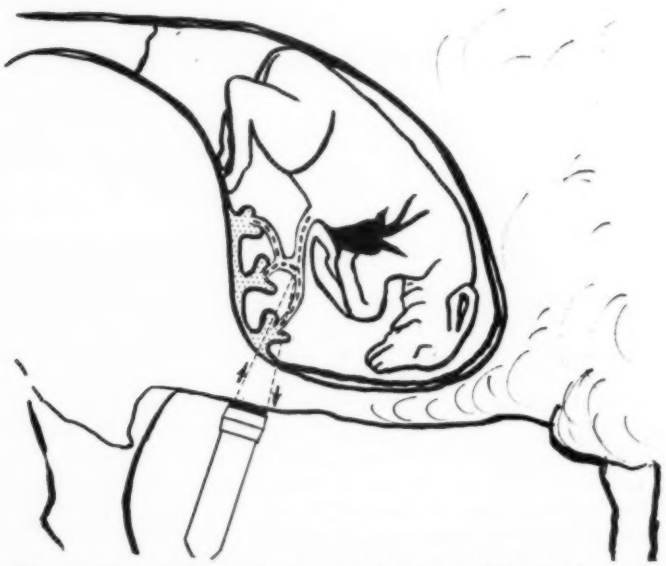

Fig. 3. Diagram illustrating the moving structures in a foetus which will reflect an ultrasonic beam. It shows the placenta (stippled), the umbilical cord (dashes) and the foetal heart (black)

Intra-rectal examination

A modified form of the transducer allows a diagnosis to be made by rectal examination. Lindahl (1971)* reports that by employing the intra-rectal probe and restraining the ewe on her back there is no loss in accuracy and thirty ewes per hour can be examined. With regard to time taken and the ease with which the instrument can be used, ultrasonic pregnancy detection compares favourably with the abdominal palpation method. The ultrasonic technique has additional advantages in obtaining a consistently high degree accuracy of over 95 per cent, the errors being due to a few detection failures. Live foetuses are detected during the first half of pregnancy, the maximum accuracy being reached during the third month of gestation.

*Lindahl, I. L. 1971. Pregnancy diagnosis in the Ewe by Intrarectal Doppler. *J. Anim. Sci.* 32, (5) 922-925.

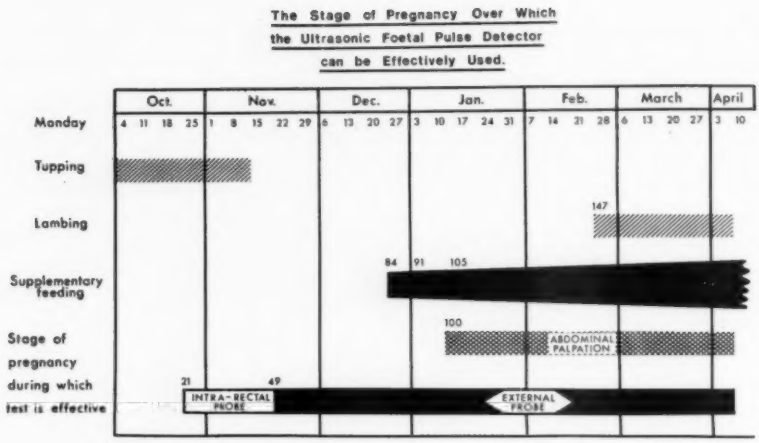

Fig. 4. Calendar of the 1971-2 breeding season. The diagram shows the stage at which abdominal palpation and the ultrasonic probe can be effectively used to detect pregnancy. A comparison is made with the dates of tupping and lambing (striped area) and the stage over which supplementary feeding takes place

If the ewes are tupped in October, barren ewes can be removed from the flock by the end of December and pregnant animals given supplementary feed.

Accuracy in detecting the size of litter is, however, poor. Wilson and Newton (1969)* reported 75 per cent accuracy if examinations are carried out at 7–8 weeks of pregnancy, at which stage the foetuses are grouped together and can be detected by placing the probe immediately in front of the udder; but at fifty days gestation the foetal hearts are very small and the chances of recording the blood flow and heart movement is more remote than at twelve weeks, by which time the accuracy of detecting litter size usually falls to 50 per cent.

The main disadvantages of the ultrasonic foetal pulse detector are the initial capital outlay (varying from £150 to £190) and the labour costs. One person can operate the instrument, and can probably organize and perform the whole operation if the sheep are run through a race; labour costs would be equivalent to those required for the usual diagnostic method of abdominal palpation. The ultrasonic technique becomes less tiring if an assistant is available but additional labour costs would amount to £10 per hundred ewes for each additional assistant employed; if thirty ewes can be examined per hour this additional cost would be reduced to £3.50. The operational cost of recharging the batteries and providing oil lubricant is 1p per ewe, which can be offset by reducing the cost of winter feeding of non-pregnant ewes, assuming a flock level of 3 per cent barrenness. Fig. 4 illustrates the stages of pregnancy over which abdominal palpation and the ultrasonic foetal pulse detector can be effectively used and compares these stages with the dates of tupping and lambing and when supplementary feeding is necessary.

Whereas Lindahl states that three assistants are required when using the intra-rectal ultrasonic probe, only one is necessary when using the ultrasonic external probe; a fairly skilled operator is required for both methods.

*Wilson, I. A. N. and Newton, J. E., 1969. Pregnancy diagnosis in the ewe. A method for use on the farm. *Vet. Rec.* 84, 356-358.

Other methods

Other methods of detecting pregnancy in ewes have evolved during the last twenty years but all require skilled operators. Radiography is frequently used; it costs 60p per ewe plus transportation costs to an institute which is willing to provide the service. The method has an accuracy of 96 per cent in detecting pregnancy at ninety days gestation but the greatest advantage of radiographical diagnosis of pregnancy is the high degree of accuracy obtained in determining litter size; in this respect it remains the best choice of method.

In Australia investigators have described a method in which under local anaesthetic a small incision is made in the ewe's abdomen and the uterus is palpated. Pregnancy is accurately detected during the fourth to sixth week of gestation and a skilled operator can perform 25-30 examinations per hour. The cost per ewe is estimated at 22p.

Finally, pregnancy can be detected by removing a piece of vaginal epithelium from the ewe for the specimen to be examined histologically at a diagnostic laboratory. This test becomes progressively more accurate from thirty days gestation onwards and reaches 90 per cent accuracy from sixty days. Although the method is quick and easy to perform the result is usually not available for two days or more and since a laboratory examination has to be paid for the cost per ewe can range from 40-83p. The test gives no indication of litter size or confirms that the foetus is alive.

Table 1

Comparison of initial capital outlay and operating and labour costs for diagnosing pregnancy per 100 ewes

Method	Intial capital outlay	Annual cost over 5 years (at 8% interest	Operating costs per 100 ewes	Average labour costs per 100 ewes	Ewes examined per hour
	£	£	£	£	No.
Abdominal palpation	0	0	0	10·50	15
Ultrasonic foetal pulse detector	150-200	37·6-50·2	1	25-8·7	10-30
Ultrasonic intra-rectal probe	160-200	40·11-50·2	—	15	30
Radiography	1,500	376·5	25	63-34	6-12
Abdominal operation	6	—	8	14-12·25	25-30
Vaginal biopsy	4	—	50	33	20

The initial capital outlays, operational and labour costs per hundred ewes of all six diagnostic methods are compared in Table I. It will be seen that the ultrasonic method is one of the cheapest and quickest tests to perform and requires the least skill.

The author acknowledges the guidance given by Mr. P. J. James, Regional Farm Management Adviser with A.D.A.S. at Reading, on the economic aspects of this paper.

Miss Carol Richardson, M.R.C.V.S. is a Research Officer at the Central Veterinary Laboratory, Weybridge.

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FARMELECTRIC

(004/005)

Improving Reliability in Peas and Beans

A. J. Gane

RELIABILITY is clearly a highly desirable asset in the production of any crop. Every grower would like to avoid those occasions when a good average is just spoiled because of the intervention of one or two factors, which are often not identified and which will, therefore, probably occur again. In the case of vegetable crops for processing, unreliability has repercussions further along the line; shortfall in the field creates problems in the factory and affects overheads and sales. Some companies over-contract to prevent such a situation, but this is a practice which clearly should be minimized and eventually dropped because it is an admission of inefficiency in crop production.

To improve reliability, it is first of all necessary to analyse the crop production situation; to isolate, identify and evaluate each factor and its influence. Only then can we hope to even out performance. Critics of such a philosophy will, of course, argue that there is still the weather to contend with when, in fact, a great many of the effects of the weather can be isolated as suggested.

Rotation

The fact that both peas and broad beans (and field beans) are hosts of the pea root eelworm (*Heterodera göttingiana*) is sufficient reason for keeping these crops well separated in time. In addition, however, there are a number of debilitating soil-borne fungus diseases which attack them and dwarf beans too, some of which have already reached serious proportions overseas.

In some cases there is uncertainty as to whether or not the races of particular fungus diseases which attack peas are in fact the same as those which attack dwarf beans or broad beans. It may be that in the light of future research we shall find that we have been somewhat over-cautious, but better that than to over-crop with peas and beans to the point where the development of soil-borne diseases becomes a serious threat to the production of these vegetables in areas closest to the processors. The motto should be 'If in doubt—don't!' Close cropping with any of these vegetables should be avoided, on the basis of results overseas, and at least until the dangers have been critically explored in this country.

Soil condition

Whichever of the large-seeded legumes is to be grown, soil condition is of the utmost importance. They are sensitive to compaction, to poor drainage and to lack of aeration, and in such circumstances will react by poor root development, little nodulation, reduced foliage and depressed yield.

Early ploughing and ample weathering, followed by a minimum of seedbed cultivations, will produce a reasonable, permeable seedbed, not so fine as to

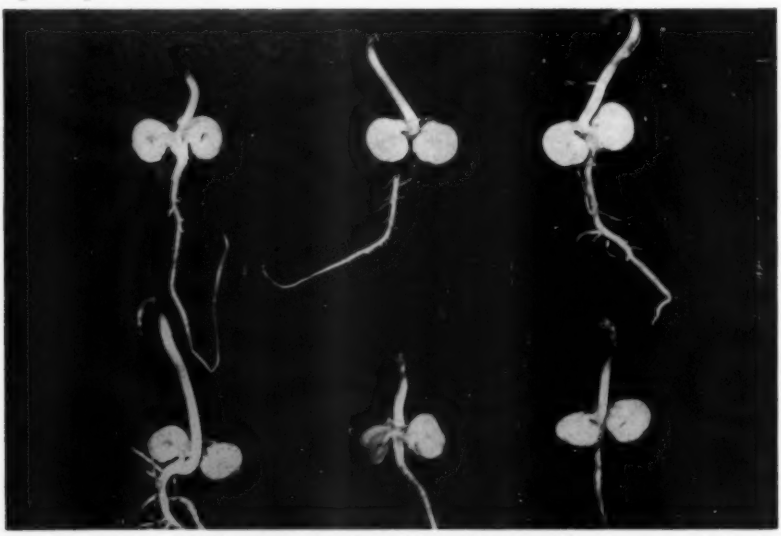
run together at the first rain but open enough to allow the root system to develop freely.

Seed health and vigour

It goes without saying that good seed is a prime factor in the production of a good crop, but we must be sure that we know good seed when we see it. For many years we have relied quite heavily on the results of laboratory germination tests as an indication of the likely performance of pea seed, but we now realize that although a sample may germinate satisfactorily there, it will not necessarily do so when sown in rigorous conditions in the field.

Whether growing vining or dried peas, the achievement of early sowing is essential if the best results are to be obtained, and it is precisely in these conditions, and in certain other conditions too, that some seed lots are least reliable.

Seeds which germinate in the laboratory but fail in relatively unfavourable conditions in the field are said to be of poor vigour. The conductivity test has been developed to assess seed vigour more easily as an added safeguard against poor stands.



Hollow heart disorder in 10 day-old pea seedlings

The physiological disorder of pea seed known as hollow heart or cavitation has been a subject of investigation at the Pea Growing Research Organisation for some years. In this disorder hollows and, in severe cases, cracks appear in the adaxial surfaces of the cotyledons during germination. Results of experiments carried out only this season indicate quite clearly that, in some cases at least, poor vigour caused by hollow heart is not reflected by the conductivity test.

Unfortunately, the testing of pea seed for hollow heart also has its pitfalls. Other P.G.R.O. experiments on this phenomenon have shown that in many samples the percentage of seeds displaying symptoms of hollow heart is not stable; often it falls during storage, so that repeated tests show a range of different results. Further studies are in progress.

Extensive series of experiments have been carried out, as reported previously, on precisely what plant populations of vining peas, each of the various types of dried peas, dwarf beans and broad beans, should be aimed at in order to achieve the best returns. The germination test, the conductivity test and the increasing knowledge of hollow heart, together with the evaluation of promising new seed protectants such as drazoxolon or 'Mil-Col', combine to afford far greater reliability in achieveing the best plant populations in the field than ever before.

Pea early browning virus (PEBV(B)), the soil-borne, eelworm transmitted disease first found in Norfolk in 1962, has also been the subject of experiments. Only recently has it been established that the virus is in fact transmissable in seed. The percentage of seeds involved is small, but it could well be sufficient to bring about the establishment of the disease if sown on sandy soils, which are those most likely to contain the nematode vectors.

The use of the produce of infected crops for seed purposes should, therefore, be carefully controlled, and confined to areas in which the disease is unlikely to become established.

Varieties

The careful selection of the most suitable varieties of peas and beans to be grown for specific purposes and in specific areas is the subject of many of the hundreds of enquiries dealt with annually at the P.G.R.O. All promising

Halo blight (*Pseudomonas phaseolicola*) *of dwarf bean*

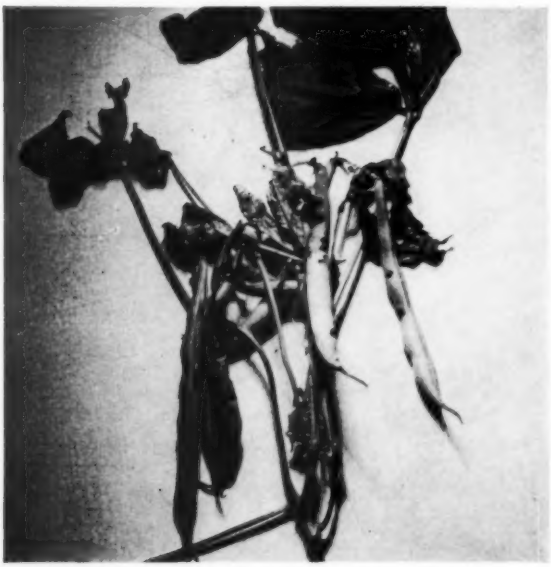
new varieties of peas are assessed for many different characters, among them being their resistance to diseases.

Downy mildew (*Peronospora viciae*) has been responsible for extremely heavy losses of vining peas and dried peas in the past, through reduction in plant population, yield depression and the spoilage of product. Now it has much less impact as the number of resistant or tolerant varieties available continues to grow.

While pea wilt (*Fusarium oxysporum f. pisi*, race I) is very much less widespread, where it does become established crops of susceptible varieties

are almost entirely lost. Again the increasing number of resistant varieties is a vital aid in overcoming a problem which, with the concentrated area of vining peas in the eastern counties, was at one time likely to become increasingly serious.

New pea varieties are also assessed for resistance to pea early browning. Although this disease has so far proved more difficult to overcome by varietal resistance, the careful selection of varieties may in some cases avoid unnecessary yield depression.



Anthracnose (Colletotrichum lindemuthianum) of dwarf bean

In the case of dwarf beans, there are a number of devastating seed-borne diseases. Bacterial diseases, such as halo blight (*Pseudomonas phaseolicola*), common blight (*Xanthomonas phaseoli*) and the fungus disease anthracnose (*Colletotrichum lindemuthianum*), have been experienced sufficiently in this country for us to know the havoc they can create, particularly if weather conditions happen to be favourable for their dissemination and development. While there are now useful treatments which can be carried out should symptoms appear, there is no doubt that the greatest safeguard is the use of healthy seed, seed from reputable suppliers who inspect their own seed crops thoroughly and accept only those which are virtually disease free.

Similarly, with broad beans diseased seed may spell disaster. Probably the most important seed-borne disease of this crop is leaf and pod spot (*Ascochyta fabae*), which is capable of causing the formation of large, dark and deep lesions on all parts of the plant; pods are penetrated and produce ruined. The advisability of testing seed for this disease is unquestionable.

Preliminary results of P.G.R.O. trials in 1971 suggest that benomyl seed treatment may prove effective in controlling seed-borne infections of this disease.

Broad bean stain virus (Syn: Evesham stain) is also seed-borne and infected crops should not be used for seed purposes.

Leaf and pod spot (Ascochyta fabae) of broad bean

Weed control

Efficient weed control in peas and beans is increasingly important in the interests of yield, throughput and quality of product. Heavy infestations depress yields, slow down the rate of cutting and vining, and there is the danger of contamination of the produce by fragments of weeds such as thistle, poppy and mayweed which are difficult to separate.

The selection of herbicides available increases continually. Whereas a few years ago there was really only one post-emergence herbicide for use in peas, there are now quite a number for both post-emergence and pre-emergence application.

The first step towards good, economical, weed control is to carefully assess the crop situation involved. What is the soil type? When are the peas to be sown? What is the variety? What weeds are expected to appear and what are the predominant species? Only when the situation has been analysed can we be sure to make the most reliable approach to methods of control.

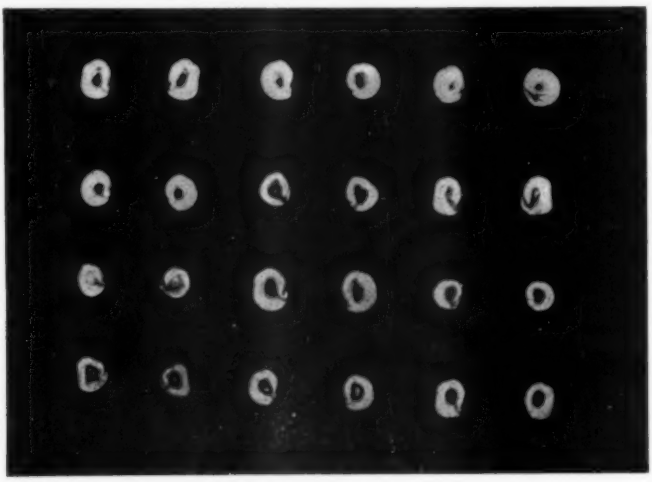
Manganese deficiency and marsh spot

Although well known for many years, often easily recognized and cheaply controlled, manganese deficiency frequently goes untreated and is allowed to

depress yield and spoil the produce of many dried pea crops, some vining peas and occasionally broad beans too. Particularly common on, though by no means confined to, organic and alkaline soils, this costly disorder can almost always be avoided by properly timed sprays of manganese sulphate.

The yellowing of foliage which the deficiency causes is almost invariably of the classic marginal and inter-veinal form in at least some plants, so that in most cases identification is not difficult.

The granulation and the brown spot which occur in the centre of the cotyledons of peas grown in conditions of deficiency much reduce the value of dried peas. Cases have been known in vining peas where the fissures in the cotyledons have been so large as to trap sufficient air to allow a large measure of separation by means of a flotation washer. Affected peas should *not* be used for seed purposes, as the resulting seedlings are liable to be malformed; many primary shoots die, being replaced by secondary ones, which of course also leads to uneven maturation.



Marsh spot affected seed

Pests

Infestations of few pests can be avoided, an exception perhaps being the pea root eelworm which is unlikely to reach serious proportions if a proper rotation is practised. Some pests, such as leatherjackets, cutworms and millipedes, can be satisfactorily dealt with if found before sowing.

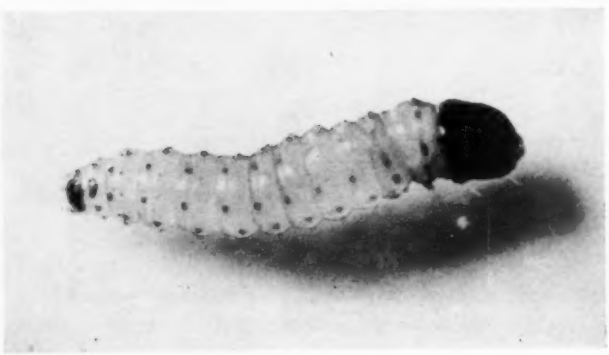
More generally, however, it is a matter of knowing what pests to expect, and when, being able to recognize the early stages of infestation and being able to decide when treatment is warranted. Warnings of the likelihood of attack by such pests as pea moth (*Laspeyresia nigricana*) and pea midge (*Contarinia pisi*) are the subject of close co-operation and consultation between P.G.R.O. and the Ministry's Agricultural Development and Advisory Service. P.G.R.O. members are also warned of the occurrence of any new or unusual pest (or disease), and in return there is an invaluable feed-back of information to the research station.

Deciding when an infestation of aphids is sufficiently heavy to warrant treatment is often difficult, but to bear in mind the effects of this particular

pest will often help. Aphids cause physical damage to pea and bean flowers and pods, causing malformation and yield reduction. Their sticky 'honeydew' causes difficulty in cleaning the produce, and it causes problems too in cleaning harvesting equipment properly. If a mobile viner or green bean harvester is not rid of this deposit, moulds are likely to develop, in particular the sooty moulds (*Cladosporium spp*) which may further hazard product quality.

In addition, aphids transmit a number of serious virus diseases, such as pea enation mosaic virus (which may cause marked reduction of yield, especially if the infection occurs early in the season), common pea mosaic and top yellows; they transmit mosaic diseases of dwarf beans and leaf roll of broad beans. When allowed to develop unchecked in vining peas they have been known to attract so high a population of predatory hoverflies (*Syrphidae*) that hoverfly pupae have become product contaminants in sufficient numbers to cause crop rejection.

There are thus ample reasons why aphids should be controlled, and in good time. A general distribution of aphids in a crop which is at or approaching a susceptible stage of development should be the signal for control measures to be carried out, particularly when conditions are conducive to rapid aphid multiplication.



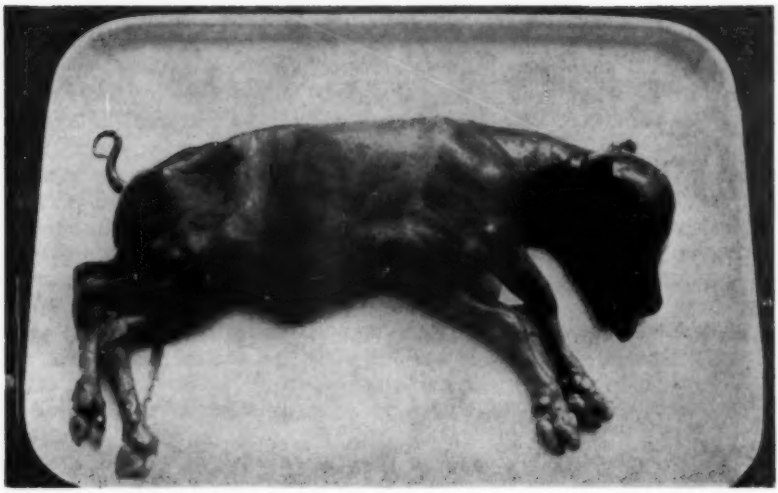
Pea moth larvae

Observation, identification and control

No matter how carefully pea or bean crop production is planned and conducted, these crops warrant frequent and careful inspection, particularly in the early stages of development and from the beginning of flowering onwards. Every assistance is offered by P.G.R.O. for the identification of problems and guidance on control measures, through advisory literature, through courses of instruction and through the provision of an advisory service which is being utilized more and more every year.

These combined approaches of specialized applied research, information and advisory services are available to all who wish to improve reliability in pea and bean growing.

The author, **A. J. Gane, C.D.A., F.R.M.S., F.R.S.A.,** is the Director of Research at the Pea Growing Research Organisation.



An aborted foetus

Brucellosis of Cattle

D. C. Croft

ALTHOUGH seven different species of the Brucella organism have been identified throughout the world, only one, *Brucella abortus*, has been found in Great Britain. This mainly affects cattle.

Survival of the organism

Outside the animal's body, if conditions are favourable, *Brucella abortus* can survive for long periods. It is, however, rapidly killed by disinfectants at the correct strength or by a few hours of sunlight; but it can survive for approximately six months in an infected foetus left lying in the shade. It has been recorded as remaining alive for a week in urine at 8°C (46.4°F), for up to a year in dung, for up to eleven weeks in slurry and for a month in dried soil or sacking. In naturally infected milk it has survived for up to ten days but much depends on the rate of souring and the associated increase in acidity; in whey it can survive for three days at room temperature. Pasteurization, ultra heat treatment or sterilization will destroy the organism and no danger exists from the consumption of such treated milk or its products.

How the disease spreads

Cattle acquire infection most commonly by consuming contaminated fodder, water, or bedding or by licking the coat or discharge of an infected

animal. The coat of a calf born to an infected dam will be heavily contaminated and the organism can be shed in the calf's dung for up to six weeks after it was last fed on infected milk. An aborted foetus or portion of after-birth always tempts the curiosity of animals in the vicinity and without doubt many cattle become infected in this way. The organism can penetrate the mucous membranes of the eye or enter the body by way of cuts and scratches in the skin. Besides acting as a mechanical carrier an infected bull can also transmit the disease via its semen, and when this happens the effect on a herd can be disastrous. Dogs, foxes and birds can carry infected material from farm to farm or infection may be introduced by persons who handle infected stock on other premises and carry the infection on their hands, clothing or equipment. Inefficient cleansing and disinfection of vehicles used for transporting cattle or of equipment used for spreading slurry and manure may also result in the spread of disease.

Disease picture

The only obvious sign of brucellosis is abortion. A high percentage of animals are likely to abort when infection is first introduced into a susceptible herd. However, abortion is a symptom of other diseases, particularly mycosis salmonellosis and vibriosis so it is important to make an early diagnosis of the cause and not assume that an abortion or a series of abortions is always due to brucellosis. The incubation period varies from a few weeks to seven months, depending on the stage of pregnancy at the time infection is acquired. There are no visible signs of disease in infected maiden heifers or barren cows but dormant infection can flare up when the animal subsequently becomes pregnant. It is uncommon for an animal to abort more than once as the cow builds up a resistance to the disease and is usually able to carry subsequent calves to full term. Thus after an initial 'storm' animals may appear to calve normally but they excrete the organisms in large numbers in their calving discharges and can spread infection, especially to introduced animals (e.g., heifers and purchased cows,) prolonging the course of infection in the herd. In the bull infection can localize in the seminal vesicles or testicles resulting in abscess formation and sterility. Calves, if infected, are thought to be able to rid themselves of infection over a period of time but instances have been reported where it is believed that infection acquired by heifer calves from their dams has lain dormant until they have become pregnant.

Diagnosis

The diagnosis of brucellosis can often be difficult and complicated. This is largely due to the way the bacteria, once established in the body, keep within body cells and are thus not exposed to the same extent as other disease-producing bacteria to the body's normal defence mechanisms. Stimulation of the defence mechanisms is variable and since diagnosis often depends on testing the blood serum to measure the resistance of the host to infection it is not surprising that difficulties can arise. A definite diagnosis can be made when the organism is cultured from foetus, after-birth, vaginal discharge or milk. At least a week is required before the result of a cultural examination is known. Blood tests can also indicate infected animals and the extent to which disease has spread in a herd. The Rose Bengal plate test (RBPT) is today in common use in Britain to screen herds for brucellosis.

Where the RBPT is positive the blood serum should be submitted to the serum agglutination test (SAT) and complement fixation test (CFT) to obtain a final result. Positive test results require expert interpretation to distinguish between reactions due to vaccination and those due to actual infection. It may be necessary to submit animals to a series of re-tests before a final decision can be made.

Vaccination

Many drugs, including antibiotics, have been used and recommended for the treatment of brucellosis but none has been found to be effective. For many years vaccination has been used to prevent or control the disease. As long ago as 1905 injections of cultures of the organism taken from infected animals were tried with variable results. From 1944 there have been official schemes encouraging the use of a modified live 'strain 19' vaccine which has proved to be safe and effective. It was shown later that the use of this vaccine in young calves was comparable with its use in older animals and that this reduced

Calf newly born to a healthy dam

the persistence of vaccinal antibodies in the blood which could be confused with those resulting from natural infection. From 1962 strain 19 vaccine has been available for vaccination of calves without charge under the Free Calf Vaccination Service (F.C.V.S.). Since November 1967 it has been available only through the F.C.V.S. for the vaccination of heifer calves between 91 and 180 days old. In the autumn of 1967 strain 45/20 vaccine was made available from commercial sources. This is a dead vaccine which appears to present no risk to pregnant animals.

How to protect your herd

Ideally the herd should be self-contained and the premises should be well-fenced to prevent contact with stock on neighbouring farms. Access to water supplies likely to convey infection and to fields or ditches contaminated by

drainage from other premises should be avoided. The use of boundary fields for arable crops gives added security. All heifer calves should be given strain 19 vaccine under the F.C.V.S. to increase the level of resistance to infection in the herd, and every precaution should be taken to prevent infection being introduced to the premises through the purchase of infected cattle or by persons or equipment, e.g., cattle lorries, the borrowed cattle crush, manure spreader or slurry tanker.

Where replacements must be purchased, animals should be obtained from accredited sources if possible. Non-accredited animals should be purchased only if they pass a blood test within fourteen days prior to movement into isolation on the farm and they must pass a further test sixty days after movement before being released to join the herd. If the purchased non-accredited animal is pregnant her second test should be deferred and she should not be allowed to join the herd until she has passed a blood test carried out fourteen days after calving. When non-accredited calves under twenty-one days old are purchased it may be more convenient to move such calves on to the farm if good isolation is available and carry out the first test within seven days of their arrival. Steers over six months of age are considered to present no danger.

Isolation premises should be easy to clean and disinfect and should be set apart from the routes regularly used by the herd. They should have separate drainage and manure from them must be disposed of carefully. They should be separately equipped (including any feeding, grooming and cleansing utensils), and the attendant should disinfect himself thoroughly before tending other stock. Non-pregnant animals can be isolated at pasture, but in the event of such cattle failing a test the field should not be grazed, except by steers, for sixty days after the reactors have been removed. The highest standards of hygiene and care are required at all times to keep a herd free from infection.

Infected herd

If a herd becomes infected the picture can vary from a single abortion to a disastrous abortion storm or from only a single reactor to a series of reactors. Control measures must be tailored to each herd and in this connection veterinary advice should be sought. Where infection is minimal it would be appropriate in most circumstances to remove all reactors and test the herd repeatedly until it is free of disease. It should be borne in mind however that under Section 106 (4) of the Agriculture Act 1970 it is an offence for a person to offer for sale, other than for slaughter, an animal known to him to be a reactor to *Brucella abortus*.

The heavily infected herd presents a serious problem. Some owners may be able to depopulate the premises, cleanse and disinfect the buildings (including slurry and manure pits), and rest pastures for sixty days before re-stocking with accredited cattle. Others may not be able to do this and find it more appropriate to 'milk and feed', i.e., stop breeding, dry off the cows and fatten for slaughter. The use of 45/20 vaccine can increase the resistance of animals in the infected herd but its indiscriminate use with no attempt to remove infected animals is unlikely to eliminate infection and the majority of the herd is likely to fail subsequent brucellosis tests. In seriously infected herds there is every chance that infection will be eliminated over a period of time if the herd is blood tested, 45/20 vaccine used on those animals which pass,

reactors disposed of and a high standard of management maintained. If animals can be isolated and tested for brucellosis at calving and if, in the light of test results, the herd can be split into groups, disease control measures are likely to be more effective.

It must be remembered that in an infected herd even an animal which calves at full-term may be infected and discharge millions of bacteria in the after-birth and fluids. The answer to this problem is one which bears repetition—always calve cows in isolation. No single action is more important than this one in the control of brucellosis.

Considerable patience, care and attention to precautionary details are necessary to eradicate brucellosis. Owners of herds which are not heavily infected will find it advantageous to join the Brucellosis Incentives Scheme, which, in addition to free testing and checking of abortions, offers attractive incentive premiums for five years from the time the herd reaches accredited status. Dairy herds qualify for 0.8p per gallon on milk, and in beef herds the payment is £5 per animal qualifying for hill cattle or beef cow subsidy. The eradication of brucellosis on an area basis commenced in four areas of Britain on 1st November 1971 and further areas have been named where eradication will begin in 1972/73. The selection of successive areas will depend mainly on the response of the industry to voluntary accreditation.

D. C. Croft, B.V.Sc., M.R.C.V.S., D.V.S.M., is a Divisional Veterinary Officer stationed at the Tolworth headquarters of Animal Health Division.

New V.I. Centre at Gloucester

A new Veterinary Investigation Centre has been opened at Gloucester. It will provide a diagnostic and consultative service for veterinary surgeons in private practice in Gloucestershire and North Wiltshire who have previously had to rely on the Centre at Langford, Bristol. It will also establish an additional link with the Central Veterinary Laboratory, Weybridge on all aspects of the health of farm livestock.

The new Centre, a conversion of existing buildings carried out by the Department of the Environment at a cost of £50,000, is manned by two professional officers supported by technical staff. It is located at Elmbridge Court, near the Ministry's Divisional Office in Cheltenham Road.

The Centre will enable the Ministry's Veterinary Staff to provide, through local veterinary surgeons, improved services to the farming industry in the area.

Appraising Capital Investment

J. H. A. Spiers, *Land Arm. A.D.A.S. Oxford*

SINCE the Second World War successive Governments, landlords, farmers and tenants have invested many millions of pounds into agriculture by way of land, stock, drainage, buildings and machinery. Their motives, though, for investing capital may be entirely different. The Government may invest for economic reasons, the landlord for tax reasons, the owner/occupier for his son's future and the tenant in order to pay for next year's rent. It is important to define the motive and afterwards the objective because both influence from the start how capital will be spent on an enterprise.

Appraising capital investment is an attempt to measure the worthwhileness of the capital invested in financial terms. The worthwhileness of different enterprises can be compared provided the same method of appraisal is used. A subjective judgment has to be taken of which method to adopt, and the aim of this article is to provide guide lines for considering this problem.

For a logical start to the capital investment problem a partial or preferably a whole farm budget and balance sheet should be prepared. There is no easy way round; the accuracy of the budget determines the validity of the exercise from the outset. The figures obtained will set out the physical structure of the farm, that is the number of acres, stocking, etc., the levels of actual performance and will give an indication of profit and loss and the amount of assets held. A forward budget of the proposed enterprise can now be prepared with much more accuracy, particularly if it is an expansion of an existing enterprise.

Four sets of figures are required for analysing capital investment:

1. The capital to be invested (fixed and working).
2. The planned investment life of the project.
3. The rate of interest or rate of return required or demanded.
4. The benefit or income to be derived from the investment.

The various methods by which these can be analysed are described below. The 'contractors' method of estimating the increased capital value of a holding by, say, erecting a new building, and the traditional 'values method' of estimating the increased rental value due to capital improvements nowadays are normally regarded as not sufficiently refined for complex investment decisions.

Methods of appraisal

GROSSED UNIT COSTS. This is a method which compares like with like and bases worthwhileness on technical soundness, the physical characteristics of the farm and standard unit costs. Although this system has the advantages of simplicity and quickness, it is entirely dependent upon the validity of the standard unit costs and can become easily outdated. Another serious disadvantage is that it tries to equate specific proposals of a particular enterprise

with only general standards for average enterprises. It is the very broadest of outlines, i.e., if a grain store costs £40 per ton gross then obviously a second look would be advisable.

PAY BACK PERIOD. This is the period in which the expected profits from the proposed enterprise will add up to the sum of money originally invested. An investment may be selected because its pay back period is the shortest or that period is less than the maximum period decreed by management. This method recognizes the benefits of early returns and measures liquidity but is not suited for appraising long term capital investment because it ignores the irregularity of cash returns or income and the income after the pay back period. It also fails to provide a positive indication of profitability.

AVERAGE RATE OF RETURN. A common way of calculating whether an enterprise is worthwhile is to express the additional income from the investment less the additional operating costs as a percentage of the additional capital investment. This system can include gross rate of return, i.e., gross return on gross capital; the interest rate of return (return on outstanding capital) and return on average capital. This is not a wholly suitable method for appraising capital investment in agriculture, particularly as it is unable to take into account the time pattern of income, and gives little indication of profitability.

ANNUAL CHARGE. This technique involves the use of discounting and compounding tables. There are two main methods:

The Annuity System. This is a calculation of equal annual repayments to recoup the initial capital charge and will include varying amounts of interest and capital. Mortgage repayments, for example, illustrate this system.

The Sinking Fund Method. This provides for a separate fund in order to repay the capital at the end of the planned investment life; but it has certain disadvantages:

(i) It assumes a once-for-all immediate capital expenditure. In most farm expansion cases capital is spent over a period of time, even on one project.

(ii) It assumes income derived from the enterprise is constant and receivable immediately. Again in the farming world this is unrealistic.

(iii) It takes no account of the terminal value of a farm building after the planned investment period.

If some or all of these disadvantages do not materially apply this relatively simple method provides a quick guide, but will be no more accurate than the information fed in. Several sums can be done to account for risk, i.e., by varying the length of the investment period, by lowering the likely income or by putting up the rate of return. If, say, a pessimistic, optimistic and average return is worked out this at least provides a valuable guide line by indicating whether or not the proposed project is worthwhile. So far this is the best method to adopt as it can indicate profitability fairly accurately and the level of output required to make the proposed enterprise viable.

DISCOUNTED CASH FLOW. The D.C.F. technique may not be popular with some but it is now recognized as a capital investment appraisal system that overcomes many of the disadvantages of other methods. It works on the principle that present money is worth more than future money and is able to allow for variable cash flows, and to estimate the effects of taxation,

fluctuating prices and other factors causing variability in the cash flows. Projects with different cash flow patterns and lengths of life can be compared and ranked together. The technique measures the amount of capital outstanding on the project at any one time and is usually used in three ways:

1. By using a predetermined rate of return. If an investor requires for a particular project a rate of return of, say, 15 per cent (the discount figure), a calculation can be done to find the net present value of the sum of the cash flows by discounting the annual cash flows at 15 per cent using present value tables. The initial investment is subtracted from the total present value of the sum of the cash flows and if the answer is positive then the investment can be regarded as worthwhile and the balance will show the profit that is likely to be made.
2. It is also possible to find the internal rate of return or discount of a project. The method indicates the rate of return which a project must have to give a net present value of nil. Thus if a project shows an internal rate of return which is less than the cost of capital it should be rejected. If the internal rate of return is greater than the cost of capital then the project will not lose money and the extent of the surplus in relation to factors such as risk will show if the project is acceptable.
3. The further use of this technique is that by predetermining the rate of return, the planned investment life and the net cash flows, viz., the admissable capital available for investment, can be determined.

The main objection to discounted cash is the tedious arithmetic involved.

Conclusion

Today the increased number of investments in all types of industry required to maintain or increase profits in a period of inflation, the uncertainty of the stableness of return, the difficulty of maintaining sufficient cash for investment, the varying interest rates, the problems of raising capital and the commitment of larger and larger capital sums all demand that at least some capital investment appraisal is carried out to see whether a capital project is worthwhile. The scale of an enterprise will give a guide line to the type of capital investment analysis used: normally the bigger the enterprise and capital required the more sophisticated the type of technique which should be used. For the every-day type of capital investment in the farming world, i.e., buying farm machinery such as tractors or combines or erecting general purpose buildings or expanding existing enterprises, the annual charge method would, given that its limitations are understood, be a suitable method to employ. It will at least give a guide to worthwhileness.

Discounted cash flow is the best appraisal method currently used in management today. Besides being able to compare different types of investments it gives an indication of worthwhileness and also reveals the feasability of an enterprise. This means whether the cash flows are sufficient to meet interest on loans and to provide a surplus adequate to cover the repayment of capital when due on fixed term loans.

'Rubbish in, rubbish out' is a frequently used expression when talking about computers. This is also true of capital investment problems. It should be remembered that there are still relatively few recognized national standards for comparing capital investment and so a decision whether or not to invest will be subjective.

Vale of Aylesbury from Coombe Hill

Farming Cameo: Series 5

5. Buckinghamshire

R. Simpson

BUCKINGHAMSHIRE is a county of contrasts, from the leafy depths of Burnham Beeches to the urban sprawl of Slough or Wycombe, from the well hedged seclusion of the Vale of Aylesbury to the windy heights of the Chilterns. Stand in Aylesbury, and the Wash, the Severn and the lower estuary of the Thames are all within seventy miles. A much-travelled county, a place in between, through which millions pass on their way from London to Cardiff or from Euston to Crewe, with barely a glance from the window of their inter-city train or speeding car on the motorway. This role as a communication link is no new feature for the county, for it was along the Icknield Way, an ancient track, that primitive man made his way from the Berkshire Downs to East Anglia. The Romans carved their way across the county when they built Watling Street and Akeman Street, providing ready access for the Legions from London to the northerly and westerly regions of Britain.

The growing pains of an industrial society have brought their share of problems to Buckinghamshire; these can be seen most vividly in the sprawling townships in the south and the construction of the new city of Milton Keynes. This development will replace some 20,000 acres of farming country with an industrial complex and the housing and leisure areas for the ¼ million people who are to settle there.

The land

The farming pattern in the county is strongly influenced by soil type. The easier working soils of the Chilterns and the Thames Valley favour arable farming but the heavy loams in the Vale of Aylesbury had for generations been devoted to a pastoral system, geared to the summer fattening of beef cattle. This centuries-old pattern has undergone some drastic changes in recent years and the traditional picture of the Vale as an area of lush permanent pastures populated by fattening cattle and sheep is no longer broadly true. In the past twenty years cereals have been increasingly grown on the better vale land with the sheep being pushed back on to the wetter land less able to support reasonable cereal yields without expensive drainage work.

The chalk derived soils of the Chilterns plateau and valleys are not inherently fertile but the high farming of the last thirty years has brought most of this area to a greater pitch of production. Sound basal manuring, coupled with high levels of nitrogen, shows that these soils are capable of giving good yields in most years although an early summer drought can wreck the best laid plans and reduce barley yields to below a ton per acre. Milk and grain are the main products of the area but some farmers have tapped a lucrative market on their doorstep, selling vegetables, eggs and cream to those townspeople with a preference for farm fresh food.

A notable feature of the Chilterns is the beechwoods; traditionally these supplied the extensive furniture industry in High Wycombe but the depredations of two World Wars have left their mark and many of the beech coppices are past their best and are cropped only occasionally. Eight and a half million people live within reach of the Chiltern Hills, an area of outstanding natural beauty, and farmer and conservationist alike face a formidable challenge during the years ahead. Local societies are actively engaged in laying plans to absorb the invasion and divert the townsman with time on his hands to areas or pursuits which will allow agriculture and wild life to flourish.

Cropping

In all, the county runs to 340,000 acres and this is split approximately 55 : 45 between grassland and tillage. The past quarter century has been a period of expansion with an increase of over 60 per cent in the total area of wheat and barley.

	Wheat	Barley	Total
1945	54,000	20,000	74,000
1971	49,000	72,500	121,500

Roots are of little account, most of the land is too heavy and not at all suited to mechanical harvesting in a wet autumn; in any event the nearest beet factory is more than forty miles away.

Horticulture

Unlike neighbouring Bedfordshire, this county is not generally suited to outdoor horticultural crops. The only area of any importance lies in the south around Slough and Marlow. Field crops and vegetables are a minor item compared to the extensive glasshouse units devoted to the cultivation of lettuce, tomatoes and cucumbers. Chrysanthemums, carnations and pot plants grown under glass or polythene are important sources of income. One of the fastest growing lines has been mushrooms, production of which has doubled since 1969.

Livestock

Traditionally Buckinghamshire is a beef fattening area relying on its lush acres for summer finishing. The county numbers amongst its farmers many experienced graziers whose skill, coupled to the ready availability of store cattle in the local markets, makes for a thriving trade. The dairy cow has replaced the fattening beast on many farms during the last fifty years although there are signs that the pendulum is about to swing the other way. Milk production is being concentrated in fewer hands with substantial capital investment funding the new installations.

The county has been to the fore in pig husbandry. Two nationally known concerns, B.O.C.M. and Walls, have established research and development stations here.

Close proximity to markets has stimulated the local poultry industry and has encouraged some of the best known names in the business to choose Buckinghamshire as the site for their major broiler and laying units.

Horsemanship has for long been a popular pursuit in this southerly extension of the hunting shires. Any student of the farming scene will recognize that stockmanship and skill is not confined to the farm yard; the Whaddon Chase, the Bicester, and the Vale of Aylesbury still attract large fields perpetuating a colourful feature of the country scene.

Ministry Publications

Since the list published in the January 1972 issue *Agriculture* (p. 41) the following publications have been issued.

FIXED EQUIPMENT OF THE FARM

FEF 46. Pig Finishing Houses (Revised) 36½p (by post 39p)
(SBN 11 240586 x)

PLANT PATHOLOGY

No. 4. Volume 20. December 1971 (New) 42½p (by post 47p)
(SBN 11 722374 3)

REPORTS

Household Food Consumption and Expenditure 1969. With Preliminary Estimates for 1970 Annual Report of the National Food Survey Committee, June 1971. (Chairman: L. Napolitan, C.B., M.Sc. (Econ.). (New) £1·58 (by post £1·65)
(SBN 11 240939 3)

TECHNICAL BULLETINS

Tech. Bull. 21. Trace Elements in Soils and Crops (New) £4·20 (by post £4·30)
(SBN 11 240921 0)

FREE ISSUES

DRAINAGE LEAFLET

No. 8. Field Drainage—Aftercare (New)

FARM SAFETY LEAFLET

Mushroom Workers Lung (New)

SHORT TERM LEAFLETS

STL 23 Chemical Weed Control in Strawberries (Revised)
STL 134 Grassland Practice No. 7 Grass as a Feed (New)

Priced publications, unless otherwise stated, are obtainable from Government Bookshops (Addresses on p. 92) or through any bookseller. Single copies of free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT.

in brief

- **Year-round cauliflower**
- **Potatoes in store**
- **Mammals mapped**

Year-round cauliflower

The focus of Report No. 5* in the Agricultural Enterprise Studies is on year-round cauliflower production in the three predominating counties in England and Wales—Lincolnshire, Kent and Cornwall. The report has been published by the Agricultural Economics Unit of the University of Exeter (author: Helen M. Cole) as the result of a survey undertaken jointly by the Universities of Exeter and Cambridge and Wye College and co-ordinated by the University of Exeter. The survey takes an objective look at a particularly market-sensitive crop, with 1963/70 as its *point d'appui*. All-the-year-round supplies, comprising the early summer, summer and autumn and winter heading crops, cater well for the consumer, but inevitably have to run the gauntlet of seasonal competition from other brassica supplies, notably cabbage and Brussels sprouts, quite apart from processed and frozen vegetables which also have all-the-year-round availability. A rising population (some 3¼ million in England and Wales during the 'sixties) obviously has the potential for increased cauliflower consumption, which is borne out by the figures (lb per year, per head) 11·8 in 1955/60, 13·7 in 1960/65 and 15·8 in 1965/70. The consumption of cabbage and Brussels sprouts also shows increases but less than those for cauliflower. In this connection it is of interest to note that over the past fifteen years the annual consumption of fresh green peas has fallen by about 1½ lb per head, thus suggesting that summer cauliflower may have gained at their expense. Cauliflower, cabbage and Brussels sprouts accounted in terms of value for 35-40 per cent of the total outdoor vegetable output of England and Wales from 1963 to 1970; and of this cauliflower (at 15%) was the highest until it was overtaken by cabbage in 1968/69.

Home-grown supplies provide about 90 per cent of our yearly consumption, derived mainly from Lincolnshire (40 per cent), Kent (13 per cent) and Cornwall (12 per cent). Lincolnshire provides nearly half the national output of the early summer crop and exactly half of the late summer and autumn crop. No single county dominates the output of winter heading cauliflower, Cornwall supplying just on one-third and Lincolnshire nearly one-quarter. The Channel Islands contribution to the home market began in the 'fifties, after a County Horticultural Adviser had moved from Cornwall to Jersey. As part of an annual early potato/cauliflower rotation to meet the winter and early spring market, such as is found in West Cornwall practice, the island exported something over 1,000 tons in 1956/57; in 1969/70 16,000 tons were exported.

The greatest single hazard in cauliflower growing is the weather, which can lose markets or glut them with equal ease and so vary the market price. The Exeter study makes this point when it says the 'pressure on market returns will doubtless continue, but seems more likely to come from competing vegetable crops than from an oversupply of cauliflowers . . . In a climate of overproduction of nearly all vegetable crops in the United Kingdom, of rising quality standards, of freer trade, of rising unit costs and narrower margins, cauliflower production seems likely to be confined to the most frost-free locations, where the highest yields can be more consistently attained and where high quality standards can be maintained.'

*Obtainable from the Univ. of Exeter, Lafrowda, St. German's Road, Exeter, EX4 6TL., price 50 p.

Potatoes in store

THE Potato Marketing Board's campaign to promote greater care in the handling of potatoes has been further advanced by its recent Conference in Scarborough. Potatoes damaged in the field (and it would be unrealistic to expect any crop to be lifted by any method unscathed) are the 'rotten apples in the barrel' once they get into the store. All too often it is either forgotten or not understood that the storage of the crop is virtually an extended phase of harvesting, not the consignment of the crop to the farm equivalent of an *oubliette*.

In this paper, Mr. C. P. Hampson, of the P.M.B., emphasized the risk of heavy loss that can occur at this stage from excessive loss of moisture and rotting. Freshly harvested tubers with a cut surface or broken skin lose moisture initially at a rate some hundred times greater than when the skin is intact. Nearly all potatoes are contaminated with bacterial soft rot, gangrene and other disease organisms, and therefore harvest-inflicted wounds offer ready entry to them. Of these, Mr. Hampson pointed to Bacterial soft rot as the most serious—'capable of causing total deterioration and loss of a whole stack or clamp in an amazingly short time'. Gangrene he placed next in importance and quoted the results of investigations at Sutton Bridge, the P.M.B.'s Experimental Station, as showing that it can be just as serious a problem to the ware grower as to the seed producer.

Work at Sutton Bridge over the past six years has also thrown light on the effect of proper environmental control in potato stores. 'Many people seem to believe that all one needs to do after lifting the crop is to load the potatoes into store, close the ventilation ducts and then after a fortnight or so open the ducts, and that's it,' said Mr. Hampson. Conditions in the store must be capable of being controlled, and in most cases, Mr. Hampson added, this merely means ensuring that a fan is installed to be used as and when necessary.

Concluding, Mr. Hampson referred to the importance of allowing potatoes to 'cure' and wounds sustained during harvesting and handling to heal immediately the potatoes are loaded into the store. Investigations at Sutton Bridge, he said, have however shown how important it is to ensure that the conditions for this wound healing and curing process should be carefully controlled. As soon as the process is complete it is imperative to reduce the temperature to the level required for the holding period as quickly as possible. This is because the conditions of relatively high temperature and high humidity that are optimal for the 'curing' and wound healing processes are also favourable for the development of diseases, and at these high temperatures moisture losses during storage are also greater and compression damage more widespread.

Mammals mapped

SINCE 1965 the Mammal Society has been collecting records with a view to preparing detailed maps showing the distribution of mammals throughout the British Isles. The result of that work is a collection of fifty maps in the Society's quarterly publication,* and although labelled provisional, they present some extremely useful information not previously available and which will also furnish a basis for further recording. Most of the maps cover the years 1960-70, and apart from their undoubted value to naturalists, they will be of especial interest to farmers, foresters and landowners. The grey squirrel is seen to be continuing its steady colonization of new areas, almost always at the expense of the red, and similarly the brown rat is pushing out the black, which is now almost wholly confined to port areas. The rabbit is again ubiquitous. Of these and other species from bats to voles and weasels, the maps indicate the national picture of the distribution of our wild mammals and, by implication, the size of certain pest problems.

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*Vol. 1 No.4/5. Copies of this issue are available from Mr. M. N. Dadd, B.Sc., The Zoological Society of London, Regent's Park, London, NW1 4RY, price 80p, plus postage.

Books

Performance Recording in Sheep. J. B. OWEN. Commonwealth Agricultural Bureaux, 1971. £2

Dr. Owen and the C.A.B. are to be congratulated on the production of this lucid and well documented monogram; the author for presenting the material in a logical and extremely readable manner and the C.A.B. for their expression of faith in the future of sheep.

A brief outline of the development of recording in dairy and beef cattle and pigs indicates that recording schemes may often have different objectives, from the short-term optimum usage of concentrates by cows to long-term breed improvement. In practice, there should be a pooling of information, e.g., A.I. bulls can only be proved when commercial producers milk-record their cows.

Because of the extensive nature of their operations sheep farmers have naturally been slow to adopt any form of recording and it is in countries such as Finland, Norway and Israel, where flocks are small in size and often housed, that sheep recording has really caught on.

Special chapters are devoted to the objectives and use of records in sheep improvement. The fewer the objectives are, the better, and they should naturally be measurable. Yet at this stage in the development of British co-operative schemes it might not be prudent to throw 'type' out entirely in pure-bred flocks. Records will, in the long run, decide whether 'type' means anything.

In lowland flocks, annual lamb production—a product of prolificacy, frequency of lambing and weight of lambs—must be the prime objective. Increased prolificacy is the order of the day, hence the interest in European breeds. While prolificacy apparently has a low heritability value it is worth noting that individuals have, by selection, succeeded in raising lambing percentages. Owen's own unique and prolific flock at Cambridge is also proof that proper pedigree information may have merit.

Feed conversion efficiency may, no doubt, become an important objective in housed sheep but little is yet known concerning its variability and heritability. Likewise, carcase quality or lean content eludes easy identification. In the meantime, farmers will continue to select for a reasonable carcase weight and against fat.

Means of minimizing environmental effects on records and the role of central stations for performance and progeny testing rams are discussed in a practical manner.

The section reviewing performance recording throughout the world will be most valuable to 'improvers' and students of sheep production. It is hardly necessary to suggest that all sheep should not be officially recorded, bodies such as the Meat and Livestock Commission could never service more that a fraction of our flocks. Improvement resulting from recording schemes in elite (or the new elite) ram breeding flocks should, however, percolate to more commercial flocks. For any scheme to have an impact on breeders and their sheep it must have few, well defined, meaningful objectives that can be recorded without much fuss and then processed quickly for 'instant' decision taking.

G.L.W.

Potassium and Systems of Grassland Farming. The Potassium Institute, 1971. *75p (post free).*

This booklet contains the papers presented at the first colloquium of the Potassium Institute, held at Hurley in 1970. They consist virtually of reviews of relevant literature, together with details of experimental work on such subjects as factors influencing the potassium content of grass; potash levels in herbage as a guide to fertilizer requirement; and so on, written by research workers and advisers. The papers presented seem to cover the subject of potash and grass production fairly thoroughly and should be valuable in that a comprehensive review of the subject is available within two covers. The booklet should be a useful reference for farmers and advisers on this very important but somewhat elusive element and should enable the enquirer to track down answers to many of the questions being asked about potassium in relation to production from grassland.

Copies of the book are obtainable from The Potassium Institute, Cedar Court, Fair Mile, Henley-on-Thames, Oxfordshire, RG9 2JT.

T.F.B.

The Introduction of High Value Crops into the Farming System. Edited by M. F. Seabrook. Reading University Agricultural Club, 1971. *75p.*

This paper-back book contains a complete report of the most recent Annual Farming Conference at Reading University. The subject was a popular one at the time and is still of considerable importance to arable farmers and vegetable growers. Farmers need to rest their land from barley and wheat to avoid the loss of soil structure which is occurring on some soils in this country; they cannot usually afford to grow the traditional grass leys and are driven to grow more profitable crops to meet the higher costs of land and other overheads.

The conference organizers therefore assembled a dozen speakers and half a dozen others to open discussions on this theme, which became known as the 'Barley or Broccoli' conference.

The papers cover most of the subjects which the arable farmer needs to consider before embarking on any major vegetable growing enterprise and provides useful background information for the established vegetable grower who is facing increasing competition as mechanization enables larger acreages to be cultivated with less hand labour.

The contributors include a farmer who already grows a wide range of horticultural crops on his large Lincolnshire farm, a vegetable breeder, research workers and economists. The marketing of vegetables is dealt with fully by economists, a representative from Covent Garden and by scientists concerned with the processing industry. The whole is summed up by a philosophical paper from Professor Hudson of Long Ashton.

After reading these reports no farmer would dare to start vegetable growing without first securing a market for his crop. He would also realize that there is much for him to learn and in most cases highly specialized machinery to acquire before a start is made. This was the general conclusion of the conference, which seemed to agree that while consumers require a more uniform, better prepared product, advances in knowledge and in the use of herbicides and machinery will enable large-scale growers more readily to meet these needs to the increasing disadvantages of the small market gardener who does not have the land to expand. Nevertheless many established vegetable growers are expanding their businesses to meet current demands and are already growing cereals as break crops in their vegetable rotations. *F.W.S.*

The Countryside and the Law. CHARLES FOX. David and Charles, 1971. *£2·50*

A feature of this book is its readability; some of the millions who daily listen to 'The Archers' will be interested in it because it is mainly concerned with the countryside and some of the many who watch Mr. Haddock—embroiled in one of his 'misleading cases' will find it fascinating because it deals with the law.

Indeed the clear way in which so many of the leading cases are explained with frequent verbatim quotations from the judgements is one of the most attractive aspects of the book. The author has also, however, explained in outline much of the recent statute law which concerns the countryside. Nor has he overlooked the need to describe the many official and quasi-official bodies who operate in rural areas, together with the extent of their interests and the limits of their powers.

Mr. Fox even gives half a page to what must have been when he was writing the book a very new baby—The Rural Development Boards. These have, he says, 'an important part to play in the Countryside'. He was not alone in failing to foresee that this particular baby would be dead and buried before it learnt to walk.

So it is certainly a book of general interest to the intelligent countryman who wants to know more of the legal framework which surrounds his habitat. But is it of value to the Farmers' Union Secretary, the accountant, the bank manager, the agricultural surveyor and others who are not lawyers but who provide a professional service in rural areas? For those not trained in law the little learning they will derive from this may encourage them to send their clients to a lawyer; it will be unfortunate if they do not and the author rightly tells them that they should.

The qualified surveyor will learn little from the book that he does not already know. Indeed there are a number of omissions—for instance the law which governs the right of one piece of land to discharge its drains on to another—omissions which could perhaps more appropriately be repaired at the expense of the chapter on Inns. Interesting though this subject is, it is hardly of exclusive or even of special interest to the countryman—or is it?

I do not think the author intended the book to be used as a textbook nor as a reference book, but treated as a book to be read for pleasure I can recommend it unreservedly.

J.D.F.

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